

Atlantic Richfield Company

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February 9, 2017

Lynda Deschambault
Remedial Project Manager, Superfund Division
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street, 10th Floor (SFD 7-1)
San Francisco, California 94105

Subject: Response to U.S. EPA Comments on Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan
Leviathan Mine Site
Alpine County, California

Dear Ms. Deschambault:

Atlantic Richfield Company (Atlantic Richfield) submits this letter in response to comments provided by the U.S. Environmental Protection Agency (U.S. EPA) on July 8, 2016 regarding the draft *Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan, Leviathan Mine Site, Alpine County, California* dated March 31, 2016 (Geotechnical TSAP). A point-by-point response to the U.S. EPA's comments is provided in Table 1. This investigation is being implemented in partial fulfillment of the requirements of the Statement of Work (SOW) attached to the Administrative Order for Remedial Investigation and Feasibility Study, Comprehensive Environmental Response, Compensation, and Liability Act Docket No. 2008-18, issued by the U.S. EPA on June 23, 2008.

Atlantic Richfield is implementing the field tasks identified in the Geotechnical TSAP as directed. The majority of the activities described in the Geotechnical TSAP were completed in 2016. During 2017, one borehole will be deepened and instrumentation will be installed, and then pore pressure and borehole inclination will be monitored. The body, tables, and figures of the Geotechnical TSAP do not require modification to address review comments nor does revision of the Geotechnical White Paper (WP) (Appendix A). The Geotechnical WP was prepared to document a review of existing site related geotechnical information available at the time and identify potential site related geotechnical data gaps. The Geotechnical WP did not take into consideration when in the CERCLA process geotechnical engineering data gaps may need to be resolved (i.e. – during the feasibility study [FS] vs. remedial design [RD] aspects). Data gaps needing to be resolved to inform the FS were identified and used to form the basis for the scope of work presented in the Geotechnical TSAP. The Geotechnical WP has served its purpose and updates are not warranted for the completion of the RI/FS. However, a new appendix to the TSAP has been developed to bridge the understanding as to when potential geotechnical data gaps may come into play during the process (FS vs. RD phase) and summarize the approach for resolving geotechnical engineering data gaps.

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We will submit a final Geotechnical TSAP after receiving your approval of these comment responses.

If you have any questions or comments, please feel free to contact me at (714) 228-6770 or anthony.brown@bp.com.

Sincerely,



Anthony R. Brown
Project Manager, Mining

Attachment:

Table 1 – Response to U.S. EPA Comments Dated July 8, 2016

Enclosure:

Appendix C - Approach for Resolving Geotechnical Engineering Data Gaps

cc: Gary Riley, U.S. Environmental Protection Agency, Region 9 – via electronic copy
John Hillenbrand, U.S. Environmental Protection Agency, Region 9 – via electronic copy
Douglas Carey, Lahontan Regional Water Quality Control Board – via electronic copy
Nathan Block, Esq., BP – via electronic copy
Adam Cohen, Esq., Davis Graham & Stubbs, LLP – via electronic copy
Sandy Riese, EnSci, Inc. – via electronic copy
Marc Lombardi, Amec Foster Wheeler – via electronic copy
Craig Weber, Amec Foster Wheeler – via electronic copy
Grant Ohland, Ohland HydroGeo, LLC – via electronic copy
Dave McCarthy, Copper Environmental Consulting – via electronic copy
Cory Koger, U.S. Army Corps of Engineers – via electronic copy
Greg Reller, Burleson Consulting – via electronic copy
Michelle Hochrein, Washoe Tribe of California and Nevada – via electronic copy
Fred Kirschner, AESE, Inc. – via electronic copy

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TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED JULY 8, 2016¹
 Leviathan Mine Site
 Alpine County, California

Comment No.	Comment	Response
General Comments		
G1	<p>Incomplete: The Geotechnical work plan is incomplete. It does not follow the tasks identified in the RI SOW attached to the June 2008 UAO. Nor does the work plan meet the objectives identified in the PWP and Programmatic DQOs. Atlantic Richfield's draft of the 2009 Programmatic Work Plan (PWP) acknowledged the need for geotechnical work in its own data quality objectives (DQO). Further, ARC's August 2010 On Property FRI Work Plan identified a geotechnical investigation (at Section 11). ARC's workplan does not include complete geotechnical investigation of landslides, high walls, mine waste, and pond areas in the current TSAP.</p>	<p>Atlantic Richfield Company (Atlantic Richfield) disagrees with the statement that the geotechnical work plan is incomplete. It is Atlantic Richfield's opinion that The <i>Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan</i> (Geotechnical TSAP) sufficiently describes the additional geotechnical characterization work that is needed to inform the Feasibility Study (FS) and the characterization needed to meet the geotechnical tasks identified in the Statement of Work for Remedial Investigation/Feasibility Study (SOW) attached to the Unilateral Administrative Order UAO. Most of the geotechnical tasks identified in the SOW do not require collecting additional geotechnical characterization data for the FS and, hence, do not need to be addressed in the Geotechnical TSAP. Geotechnical tasks identified in the SOW but not included in the Geotechnical TSAP are being addressed through Remedial Investigation (RI) characterization activities, or by performing engineering evaluations that do not require collecting additional geotechnical characterization data. The response to Comment G2 (below) provides more detail on the approach for addressing the geotechnical tasks identified in the SOW.</p> <p>The data quality objectives (DQOs) and geotechnical investigations based on those DQOs have evolved during the RI/FS planning process. The Geotechnical TSAP submitted March 31, 2016, includes the current DQOs and describes the geotechnical characterization activities that will provide information of adequate quality needed to conduct the FS.</p> <p>SOW Part I Section E – Geotechnical Engineering Evaluation describes the tasks that pertain to the landslide area, the Pit highwall, mine waste slopes, and existing pond berms, and consistently uses the terms “assessment” and “evaluation.” These terms do not imply that additional characterization data must be collected – only that existing data be assessed and evaluated. In contrast, the wording for the tasks that pertain to geophysical surveys, visual inspection, and completion of subsurface explorations all clearly require collection of additional information. The landslide area, the Pit highwall, and mine waste slopes and pond embankments (other than the Ponds 2N/2S embankment) will all be assessed and/or evaluated, but collection of additional geotechnical characterization data is not needed to perform those assessments for the FS. Therefore, characterization of those features does not need to be included in the Geotechnical TSAP nor should it be inferred that the Geotechnical TSAP is incomplete.</p> <p>In the event that additional geotechnical characterization information is needed in the future to support Remedial Design (RD) (defined in 40 CFR § 300.5 as “the technical analysis and procedures which follow the selection of remedy for a site and result in a detailed set of plans and specifications for implementation of the remedial action”), then the additional information needed may be collected during the RD phase.</p>
G2	<p>SCOPE: A recent EPA and ARC telephone call regarding the scope of this workplan, clarified that ARC's intent is to apply this collected information to the evaluation of other storage pond expansion options. However, EPA still notes that part, Item E (Page 13) of the Statement of Work to the UAO clearly outlines the Geotechnical work to be completed. See Attachment A.</p>	<p>Please refer to the response to Comment G1 for an overview of the approach for addressing SOW requirements that require collecting additional characterization data and those that can be addressed by evaluating or assessing existing information.</p> <p>The planned approach for addressing each of the tasks identified in the SOW Part I Section E – Geotechnical Engineering Evaluation is summarized below.</p> <p>1. Task: “Review of groundwater level data collected from groundwater monitoring wells in the vicinity of the Leviathan Mine.”</p> <p>Approach: Groundwater-level data from pre-RI wells and piezometers along with data from monitoring wells installed as part of the RI are being compiled and interpreted as part of the RI hydrogeology evaluation.</p> <p>Status: In progress.</p>

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 Alpine County, California

Comment No.	Comment	Response
		<p>2. Task: "Completion of geophysical surveys across the Leviathan Mine and adjacent areas in an attempt to determine the stratigraphy and relative density of subsurface materials, and identify subsurface geologic features that may affect stability."</p> <p>Approach: Geophysical surveys were conducted adjacent to Leviathan Creek and in the Pond 4 / Delta area during 2011 to locate underground infrastructure and investigate subsurface geologic conditions. Geophysical surveys (seismic refraction and Refraction Micro Tremor methods) were conducted at two locations on the Ponds 2N/2S embankment in August 2016 as part of the activities described in the Geotechnical TSAP, to provide information about the stratigraphy and the density of subsurface materials. Geologic conditions across the site are being investigated via the RI hydrogeology evaluation. The interpretation of subsurface geologic conditions has been illustrated as a series of cross sections and fence diagrams documented in the three-dimensional Hydrogeochemical Conceptual Site Model (HCSM) maintained in the Groundwater Modeling System (GMS) environment. The HCSM will be updated based on the results from the 2016 drilling program. The geologic model based on geophysical surveys and the hydrogeology evaluation drilling program will meet the objectives of the geophysical survey task in sufficient detail to support the FS.</p> <p>Status: Complete.</p> <p>3. Task: "Visual inspection and assessment of the existing structures to evaluate whether additional investigations are necessary."</p> <p>Approach: Pond embankments, and facilities in the Pond 4 and Aspen Seep areas were visually inspected during preparation of the Geotechnical TSAP. Although no structural deficiencies were identified, additional investigation of the Ponds 2N/2S embankments is needed to support the FS. Plans for that investigation are described in the Geotechnical TSAP.</p> <p>Status: Complete.</p> <p>4. Task: "Completion of subsurface explorations to characterize the native materials beneath the mine waste piles and other areas of interest."</p> <p>Approach: Mine waste and underlying native materials at Ponds 2N/2S are being characterized pursuant to the Geotechnical TSAP. The RI hydrogeology evaluation has provided information about lithology on a site-wide basis.</p> <p>Status: Geotechnical TSAP characterization activities began in August 2016. Drilling was terminated in anticipation of the onset of winter conditions. Additional geotechnical drilling activities and installation of instrumentation are scheduled for 2017, and slope monitoring will continue through the 2017 field season. The RI hydrogeology evaluation drilling program was completed in 2016.</p> <p>5. Task: "Assessment of mine shafts, adits, tunnels and galleries to determine their interaction and connection with other structures."</p> <p>Approach: The locations of underground workings were identified from survey records and maps prepared during the active life of the mine. The three-dimensional location and orientation of these features relative to geologic materials, monitoring wells, the Pit bottom and sides (both at the end of mining and at present) are incorporated into the HCSM. This HCSM shows that some of underground workings were located in rock that was excavated during open pit mining, and some of the remaining workings are above the water table outside the pit. Adit 5 is below the water table beneath and adjacent to the pit and, thus, acts as a hydraulic drain. The location of the underground workings relative to other site infrastructure is also documented in the HCSM.</p>

TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED JULY 8, 2016¹
 Leviathan Mine Site
 Alpine County, California

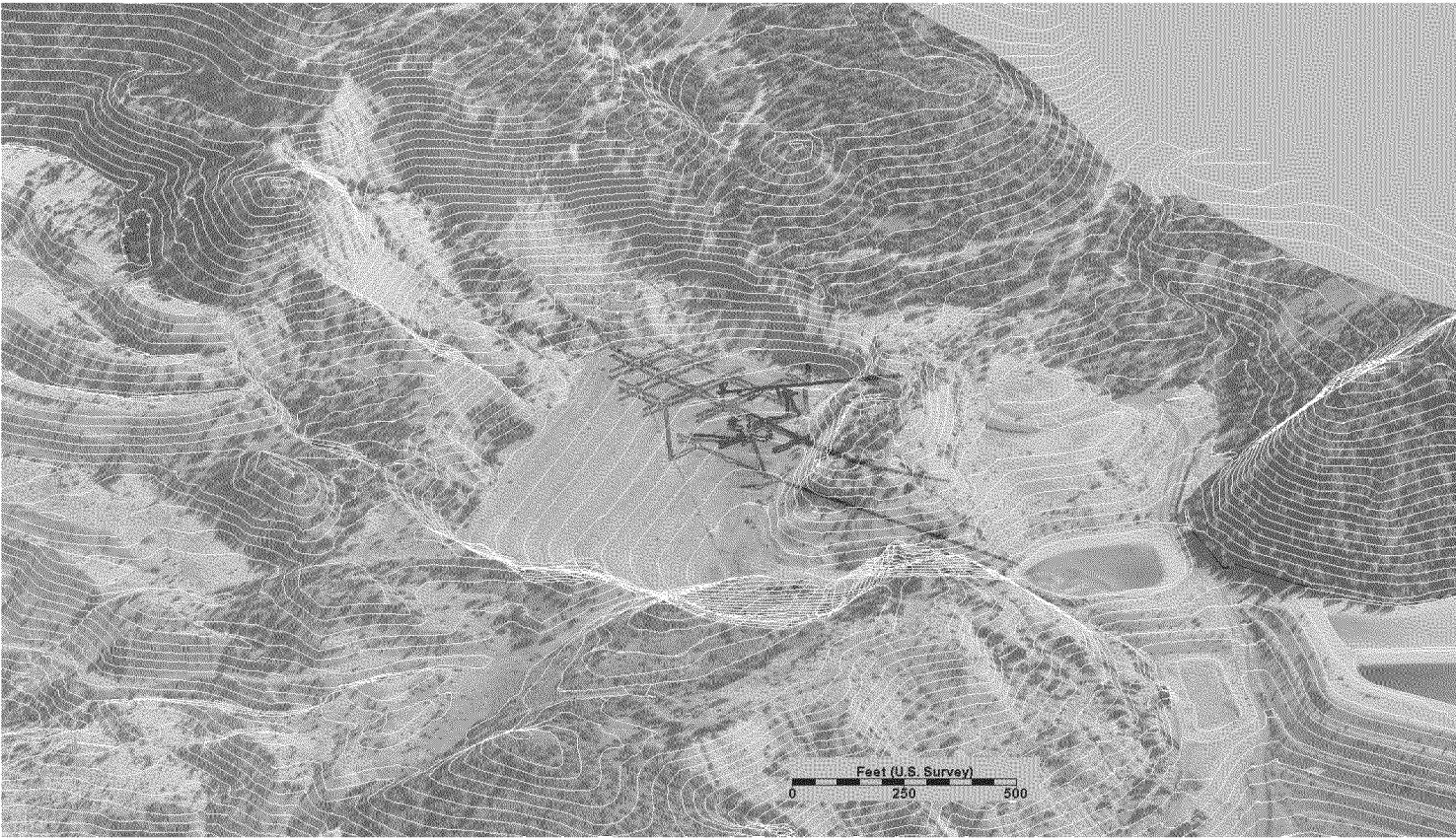
Comment No.	Comment	Response
		<p>Section 4.6.1 of the draft <i>Groundwater Technical Data Summary Report</i> (Atlantic Richfield, 2016) summarizes historical information regarding the relationship between underground workings and groundwater, and Figures 4.7 and 4.10 are examples of cross sections in the HCSM that illustrate the relationship between underground workings and other site features. The graphic below is a three-dimensional oblique view that shows underground workings (shown in red) in relation to topography and other site features, which was produced using information in the HCSM.</p>  <p>Status: Complete</p> <p>6. Task: "Geotechnical assessment of the existing evaporation pond berms for structural integrity as well as an assessment of the potential for increasing pond capacity through raising the berms and/or level of the outflow pipes. Consideration should be made of theseismicity of the surrounding area, height and competency of the impermeable liners and the effect of potential wave action."</p> <p>Approach: The Geotechnical TSAP focuses on evaluating geotechnical characteristics of the Ponds 2N/2S embankments, and the scope of work will provide information needed to conduct an initial evaluation of slope stability of that embankment in multiple configurations: current, if the berms are raised, if the outflow pipe is raised, or if the pond interior is excavated. The slope stability assessment will consider site-specific seismic ground motion.</p>

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Comment No.	Comment	Response
		<p>Although collection and analysis of geotechnical samples from the embankments of the other site ponds is not planned (due to their smaller size relative to Ponds 2N/2S), preliminary stability assessments of Pond 1, 3, and 4 embankment can be conducted using conservative assumptions for geotechnical conditions and material property values. In particular, the embankments of all of these ponds are constructed of similar material, and thus the material properties measured at Ponds 2N/2S can be used to evaluate the stability of the other pond embankments. These slope stability calculations will include ground accelerations caused by seismic events.</p> <p>The integrity of the liners in Ponds 1, 2N/2S, 3, and 4 was assessed in 2011 using an electrical geophysical technique to identify leaks in the liners. If remedial alternatives that include raising the pond embankments are selected for evaluation in the FS, then increasing the height of the pond liner will be included in the evaluation of that alternative.</p> <p>Wave run-up on embankments is typically managed by maintaining sufficient freeboard between the top of the embankment and the pond water level. Established engineering approaches for determining freeboard requirements will be used in the FS during evaluation of remedial alternatives that include raising the height of pond embankments or constructing new storage ponds.</p> <p>Status: Collection of geotechnical data at Ponds 2N/2S began in August 2016. Geotechnical drilling and instrumentation installation began in 2016 and will be completed in 2017, and slope monitoring will continue in 2017. Preliminary evaluation of pond embankment stability will be conducted as part of the geotechnical evaluation.</p> <p>7. Task: "Geotechnical assessment of mine waste slopes and high walls for stability and safety. Conduct an evaluation of the stability of high walls at the pit, stability of slopes on mine waste piles and associated areas. This evaluation should focus on identifying areas where cut and/or fill or other engineering methods will be necessary to prevent the failure of slopes and associated hazards to human health and the environment. Evaluation of the optimal slopes for minimizing erosion and facilitating revegetation efforts shall also be made."</p> <p>Approach: Additional geotechnical investigation is not needed to confirm that the pit highwall is marginally stable, or to inform the FS. In the event that highwall stability affects implementation of the selected remedy, then additional geotechnical evaluations of the highwall would be performed as needed during remedial design.</p> <p>The Geotechnical TSAP provides the geotechnical information needed to evaluate slope stability of the Ponds 2N/2S embankment and other mine waste slopes. A preliminary evaluation of the stability of other slopes in mine waste and overburden can be based on conservative assumptions of geotechnical conditions and material properties. Those material property values can be estimated based on the geotechnical data collected at the Ponds 2N/2S embankments, on lithologic information collected in the RI hydrogeology evaluation, and using published values for geotechnical properties typical of the material types present at the site.</p> <p>Evaluation of earthwork or other engineering measures to increase slope stability will be done as part of the FS if remedial alternatives identified for evaluation include such measures. If so, conservative assumptions will be used as the basis for evaluating the technical feasibility and cost of remedial alternatives. In the event that the Record of Decision (ROD) selects a remedial alternative that includes stabilization of slopes, then additional geotechnical characterization data may be collected, as needed, as part of RD.</p> <p>Remedial alternatives that include earth work for flattening slopes to reduce erosion and facilitate revegetation may be evaluated in the FS. No additional geotechnical data has to be collected to support that evaluation.</p>

TABLE 1
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 Leviathan Mine Site
 Alpine County, California

Comment No.	Comment	Response
		<p>Status: The Geotechnical TSAP activities began in 2016 and are scheduled to be completed in 2017, and the RI hydrogeology evaluation drilling program was completed in 2016. Evaluation of slope stability for locations other than the Ponds 2N/2S embankment will be done as needed during the FS.</p> <p>8. Task: "Landslide Area Evaluation. The landslide extending from the overburden waste pile to the vicinity of the confluence of Leviathan and Aspen Creeks is known to be active. Water quality of ponds and seeps indicates that acidic conditions are present within the landslide. The proximity of mine wastes at the head of the landslide begs the question as to whether continued movement of the slide could enhance the migration of mine wastes to the environment. A geotechnical assessment of the landslide area is necessary to determine the potential for mine wastes to be mobilized by continued landslide activity. In addition, investigation are necessary to determine if water flow through the landslide mobilizes mine waste constituents and/or contributes to continued instability of the landslide."</p> <p>Approach: The horizontal extent and approximate rate of movement of the Leviathan Creek Basin Landslide (LCBL) was evaluated in John Sciacca's (1984)² graduate studies. More recent aerial photographs can be examined to evaluate the recent extent and rate of movement. Knowledge of the horizontal extent and approximate rate of movement is sufficient for FS evaluation of remedial alternatives that include infrastructure that might be affected by the LCBL. The long-term movement rates can be used to estimate the time (or time period) that would be required for mine waste deposited on the LCBL to travel down-slope to Leviathan Creek or Aspen Creek, where it could be eroded from the toe and transported downstream.</p> <p>The RI hydrogeology evaluation will assess concentrations of constituents that are possibly derived from mine waste and/or in situ rocks on a site-wide basis, including the LCBL.</p> <p>Status: The horizontal extent and historical rate of movement of the LCBL was evaluated by Sciacca (1984). His assessment can be updated by evaluating more recent aerial photographs during preparation of the geotechnical evaluation report. In addition, the displacement needed to transport mine waste to the toe of the LCBL at Leviathan Creek will be calculated as part of the geotechnical baseline report.</p> <p>The RI hydrogeology evaluation drilling program was completed in 2016, and periodic groundwater level monitoring is anticipated to continue until the final remedy is selected upon which a long-term monitoring program would be designed and implemented consistent with the selected remedy.</p>
	Further, the work plan Atlantic Richfield provided on August 10, 2010, Section 11 pages 85 thru 89 (Attachment C) clearly outlined that the full scope of the Geotechnical work to be completed includes geotechnical characterization and mapping, evaluation of storage pond expansion, and slope monitoring.	The DQOs and the tasks needed to satisfy them have evolved during the RI planning process; thus, the current DQOs and associated tasks differ somewhat from those envisioned in 2010 during the early stages of planning the RI/FS. Nevertheless, the Geotechnical TSAP activities include geotechnical characterization, mapping, and slope monitoring. Water balance and pond storage capacity were thoroughly evaluated as part of the focused feasibility study and treatability investigation for Interim Combined Treatment (see Interim Combined Acid Drainage Treatability Investigation Report, December 18, 2015).
	ARC should proceed with the work outlined in this TSAP.	Atlantic Richfield implemented most of the scope described in the Geotechnical TSAP in 2016 and will complete the remaining characterization scope in the 2017 field season. Monitoring activities will continue afterwards.

TABLE 1
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Leviathan Mine Site
Alpine County, California

Comment No.	Comment	Response
	However the geotechnical work should be expanded to address Section I E of the RI SOW including expansion of storage at all of the ponds present, evaluation of slope stability on mine waste and high walls at the site, monitoring of slopes along the Leviathan Basin Landslide, and potential impacts to existing infrastructure such as existing roads, the Aspen Seep Bioreactor, and future infrastructure such as pipelines and new storage ponds.	<p>Please see the first portion of the response to Comment G2 for a description of our approach for addressing the geotechnical tasks identified in the SOW.</p> <p>The activities described in the Geotechnical TSAP will provide the geotechnical characterization data needed to evaluate various approaches for increasing the storage capacity of Ponds 2N/2S, which have the potential for the greatest increase in storage capacity. Approaches for increasing storage capacity of Ponds 1, 3, 4 can be evaluated during the FS using conservative estimates of geotechnical material property values to evaluate the stability of the embankments at those ponds. In the event that the ROD selects a remedial alternative in which the storage capacity of any of the ponds is increased, then more detailed geotechnical characterization data needed for design may be collected, as needed, during RD.</p> <p>Geotechnical TSAP activities include collecting the geotechnical information needed to evaluate the stability of embankment slopes in mine waste at Ponds 2N/2S.</p> <p>If remedial alternatives that include engineering measures for addressing the Pit walls are evaluated during the FS, then reasonable assumptions will be made in order to evaluate those alternatives. In the event that the ROD identifies a remedial alternative that includes such engineering measures, then additional geotechnical data may be collected, as necessary, during RD.</p> <p>The potential effects of ground movement on existing or new infrastructure will be considered during remedial alternative evaluation. The appropriate engineering approach includes siting infrastructure to avoid unstable ground to the extent practicable, designing infrastructure to accommodate limited ground movement, and planning for periodic monitoring, maintenance and repair during remedy implementation. With this approach, the information needed includes the lateral limits of unstable ground and the expected rate of movement. As described in the first part of the response to Comment G2, this information will be generated as needed to evaluate remedial alternatives in the FS.</p>
G3	Purpose and Objectives: Atlantic Richfield's March 31, 2016 TSAP is based on the two PWP objectives prepared by Atlantic Richfield in 2009, plus a third objective (GT-3, slope monitoring) identified in the August 2010 On Property FRI work plan. As indicated in the background section above, the PWP objectives provided by ARC were not accepted by EPA. Rather EPA prepared the program DQOs for Leviathan Mine in our December 9, 2010 letter (Attachment B).	The TSAP is not "based on the two PWP objectives" from 2009. Section 4.0 of the TSAP describes the applicable DQOs and the process by which they were developed. The DQOs for all components of the RI/FS, including geotechnical characterization and evaluation, have evolved over time. The DQOs described in the 2010 Programmatic DQOs are general and do not conform with the seven-step DQO planning process described in U.S. Environmental Protection Agency (U.S. EPA) guidance. In contrast, the more recent DQOs, such as those submitted as part of the Geotechnical TSAP in March 2016, are more specific and conform to U.S. EPA guidance.
	The geotechnical evaluations described within the TSAP are narrowly constrained and focus on the use or modification of existing Ponds 2N and 2S, and visual inspection of the possible location for a potential future new pond. The proposed geotechnical investigation does not fully address the requirements in the RI SOW, nor the data gaps identified in the TSAP Appendix A, Engineering Evaluation of Existing Geotechnical Information White Paper/Engineering Evaluation (Geotechnical WP/EE).	<p>The Geotechnical TSAP focuses on collecting the geotechnical characterization data needed to assess the stability of the mine waste embankments at Ponds 2N/2S, collecting slope movement data, characterizing native materials beneath the mine waste, and geotechnical/geologic mapping needed to support siting of a new storage pond. This information is needed to conduct the FS. As described in the response to Comment G2, the geotechnical tasks identified in the SOW that are needed to inform the FS have been or will be addressed by a combination of activities conducted as part of the Geotechnical TSAP, the RI, and the FS.</p> <p>The Geotechnical White Paper (WP) was prepared early during the process of planning geotechnical characterization activities described in the Geotechnical TSAP, and is a historical planning document that has served its intended purpose. There is no need to revise the Geotechnical WP at this time.</p>

TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED JULY 8, 2016¹
 Leviathan Mine Site
 Alpine County, California

Comment No.	Comment	Response
	EPA requests that ARC provide a full and complete workplan for geotechnical investigations to assess the stability of pit high walls, steep slopes on mine waste, landslides, and existing infrastructure such as the Leviathan Mine Road and Aspen Seep Bioreactor, (the TSAP defers such investigations to future efforts), and to complete remedial design.	<p>The Geotechnical TSAP is a full and complete workplan for geotechnical investigations needed to evaluate the stability of pond embankments and inform the FS. Atlantic Richfield proceeded with implementing activities described in the Geotechnical TSAP in accordance with the U.S. EPA conditional approval dated July 7, 2016. As described in the response to Comment G2, additional geotechnical characterization does not need to be performed to evaluate other slopes or infrastructure and, hence, was not included in the Geotechnical TSAP. Those slopes and infrastructure will be evaluated in the FS using existing information and characterization information for the Ponds 2N/2S embankment as described in the Geotechnical TSAP.</p> <p>During the RI/FS, the level of detail in geotechnical characterization studies must be sufficient to evaluate remedial alternatives and select a remedy; but not necessarily to the level of detail to complete a remedial design. Consistent with the NCP, additional data collection and technical analysis needed to support detailed plans and specifications for implementation of the remedial action will occur during the RD phase. In the event that the selected remedy includes engineering measures that require geotechnical engineering design, then more detailed geotechnical characterization data may be collected during RD. Without knowing the geotechnical engineering measures, if any, that will be included in a future selected remedy, it is impractical to collect all geotechnical information that might be needed to complete remedial design for every alternative evaluated during the FS.</p>
	The scope of the geotechnical investigation should be expanded to adequately support the feasibility study by addressing the data gaps identified in the Geotechnical WP/EE and to meet the requirements of the RI SOW.	<p>The activities described in the Geotechnical TSAP are sufficient to support the FS and the scope of the geotechnical investigation does not need to be expanded to support the FS or meet all of the requirements of the RI/FS SOW at this time. Please see the response to Comment G2 for the planned approach for addressing the tasks identified in the <i>UAO Statement of Work for Remedial Investigation / Feasibility Study</i> Part I Section E Geotechnical Engineering Evaluation.</p> <p>The Geotechnical WP was prepared as a planning document and was used to support development of the scope of work presented in the Geotechnical TSAP. Data gaps that need to be resolved to inform the FS and that require collection of new site-specific characterization data are addressed in the Geotechnical TSAP, while other data gaps needed to inform the FS will be resolved using existing or readily available public information. Some of the potential data gaps identified in the Geotechnical WP may need to be resolved only to implement a specific remedy or component thereof, and those will be resolved as needed, based on the selected remedy, during the remedial design.</p>
G2 (error in numbering. Should be G4)	<p>Consistency: The TSAP and Geotechnical WP/EE are inconsistent. The Geotechnical WP/EE identifies numerous geotechnical data gaps that are not addressed in the TSAP. For example, installation of inclinometers are identified as an activity for addressing data gaps at the Delta Slope in Section 5.2.2 of Appendix A, but are not included within the TSAP. The TSAP should include the activities for addressing the data gaps identified in the various sections of the Geotechnical WP/EE.</p> <p>In addition the TSAP and Appendix A both use GT labels to identify investigation components. However, different components are given the same label in the two documents (for example, GT- 1 in the TSAP refers to Geotechnical Characterization and Evaluation and GT-1 in Appendix A refers</p>	The Geotechnical WP was prepared in conjunction with reviewing existing geotechnical information to support initial planning of the geotechnical investigations. The approach for meeting the requirements identified in the SOW and DQOs evolved as the Geotechnical TSAP was prepared. The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.

TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED JULY 8, 2016¹
Leviathan Mine Site
Alpine County, California

Comment No.	Comment	Response
	to Leviathan Creek Basin Landslide). Please ensure that the labels used in the TSAP and Appendix A WP/EE are consistent.	
G3 (error in numbering. Should be G5)	<p>Completeness: The TSAP does not address questions relevant to the narrow constraint outlined. For example, the investigation of the Potential Area for New Storage Pond is limited to geotechnical mapping. Geotechnical mapping alone would not fully address data gaps regarding the potential interactions of elevated pore pressures in the slopes adjacent to the future pond with slope stability. Nor does it assess whether movement of the Delta Slope or Leviathan Creek Basin Landslide could compromise the function of the pond. In addition, with no current knowledge of the movement of the Leviathan Creek Basin Landslide, it is difficult to determine how feasible the new storage pond would be.</p> <p>Please include additional investigations to provide site specific information regarding geotechnical soil properties, and slope movement rates (at the landslides) to address all data gaps prior to assessing the feasibility of a new storage pond.</p>	<p>The purpose of the mapping activity in Leviathan Creek is to identify potential sites for constructing an additional pond to provide additional storage volume in order to inform the FS, not to provide detailed information needed for remedial design or remedial action implementation. In the event that suitable location(s) for a pond are identified adjacent to Leviathan Creek, and if the selected remedy includes such a pond, then additional geotechnical characterization and design may be conducted as part of the RD activities. Detailed geotechnical characterization information beyond that described in the TSAP is not needed to perform the FS.</p> <p>The lateral limits of the Delta Slide and the LBCL have already been mapped. The siting criteria for a new pond include locating it outside areas where future movement of known landslides could affect a new pond so that movement of either landslide will not affect the function of a new storage pond that might be built. Thus, the mapping / siting study provides the site-specific information sufficient for the FS.</p> <p>In the event that the selected remedy includes construction of a new storage pond, it would be appropriate to collect data needed for engineering design of the pond. Additional site-specific information regarding geotechnical soil properties is not needed to evaluate the feasibility of remedial alternatives that might include the construction of a new storage pond.</p>
Not numbered	<p>Attached, please find a matrix relating potential effects of the Leviathan Creek Basin Landslide on possible components of potential future remedies as an example of the types of impacts this landslide could cause. Please ensure the geotechnical investigation is broadened to provide information to allow evaluation of the feasibility of implementing such potential remedies as expanding each of the existing storage ponds, building a new storage pond or ponds to capture acid drainage via gravity, and maintenance of infrastructure necessary to remediate the site.</p> <p>Please prepare similar evaluations to support the rationale for the geotechnical investigations of other site features (including and not limited to assessment of the stability of slopes on mine waste piles, pit high walls, and Delta Slope) necessary to support the Leviathan Mine FS.</p>	The investigation described in the Geotechnical TSAP provides the additional geotechnical characterization data to be collected for a more informed FS.
Specific Comments		
S1	Page 4: This information is not relevant to "Site Features." This paragraph should be moved to the end of the introduction before Section 1.1.	Comment noted. However, the Geotechnical TSAP does not need to be modified in order to collect the geotechnical characterization and monitoring data needed, and thus the requested minor change to the text will not be made.
S2	Section 5.0, Scope of Work, Page 12: Tasks should be identical to those identified as necessary to address the data gaps identified in the Appendix A	The Geotechnical WP was prepared in conjunction with review of existing geotechnical information to support planning of the scope of work presented in the Geotechnical TSAP. The approach for meeting the requirements identified in the UAO SOW and the DQOs identified in the

TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED JULY 8, 2016¹
 Leviathan Mine Site
 Alpine County, California

Comment No.	Comment	Response
	Geotechnical White Paper/Engineering Evaluation (WP/EE). In addition the data gaps should be related to the DQOs of Appendix B. As-is there appear to be multiple sources used to define the scope of the geotechnical investigation (DQOs of Appendix B, the WP/EE in Appendix A, PWP work plan, On Property FRI work plan, and broad unsupported statements regarding what is necessary to support the feasibility study within the TSAP text). Please develop the DQOs based on evaluation of existing information, and project requirements. Further, please develop the investigation tasks to address the data gaps identified during development of the DQOs. Please ensure the DQOs and WP/EE are integrated to develop a complete scope of work for the geotechnical investigations to address the RI SOW and fully support the feasibility study.	Geotechnical WP was refined as the Geotechnical TSAP was prepared. Hence, the DQOs identified in the Geotechnical TSAP Appendix B supersede information included in the Geotechnical WP. The geotechnical characterization activities described in the Geotechnical TSAP are sufficient to support the FS.
S3	Appendix A, Geotechnical WP/EE. Please make sure that references listed in Tables A- 3A through A-3E and A-4 are consistent with those listed in the text.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S4	Appendix A, Geotechnical WP/EE. Please compare information from Tables A-3A through A-3E with the text and ensure it is consistent.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S5	Appendix A, Geotechnical WP/EE. Please insert the appropriate Geotechnical Evaluation Area in parentheses next to each header in Section 5.0. For example, change the header for Section 5.1 to: "Leviathan Creek Basin Landslide Area (GT 1)."	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S6	Appendix A, Geotechnical WP/EE. Tables A-3A to A-3E. Please insert the appropriate Geotechnical Evaluation Area in the title of each table. For example, in Table A-3C, insert "Geotechnical Evaluation Area 3" beneath "POND EMBANKMENTS AND WASTE ROCK STOCKPILES."	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S7	Section 3.0, last paragraph. Please reference Figure A-2 in the sentence preceding the GT list.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S8	Section 5.0. Please provide an introductory paragraph before Section 5.1 such as: "Area– specific data will be collected for five geotechnical evaluation areas, shown on Figure A-2. Tables A-3A, A-3B, A-3C, A-3D, and A3E summarize area-specific data (ASD) for geotechnical evaluation areas GT 1, GT 2, GT 3, GT 4, and GT 5, respectively, with details provided in Sections 5.1 through 5.5."	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.

TABLE 1
RESPONSE TO U.S. EPA COMMENTS DATED JULY 8, 2016¹
 Leviathan Mine Site
 Alpine County, California

Comment No.	Comment	Response
S9	Sections 5.1.1, 5.2.1, 5.3.1, and 5.4.1. Information Needed and Available. Last sentence “No information is required” is confusing, as the preceding sentence infers that information is required. Please remove this sentence.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S10	Section 5.1.4. Last sentence of first paragraph states that a 2D model will be used although significant 3D effects are anticipated. EPA requests that a 3D model be used. If not practical, please explain how a 2D model could be useful.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S11	Gap in comment numbering	Not Applicable
S12	Section 5.6, last paragraph. Table A4 does not list any proposed infrastructure. The limited geotechnical investigation includes visual inspection of the location for a future new storage pond. This new storage pond constitutes proposed new infrastructure. Please add the new storage pond and other potential future new infrastructure (for example pipelines) to the table.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.
S13	Section 6. Remote Sensing Survey is not included in bullets, but is listed on tables. Please include the remote sensing survey in a bullet.	The Geotechnical WP is a historical planning document that has fulfilled its purpose, and there is no need to revise it at this time.

Note(s):

1. U.S. EPA, 2016. *EPA Comments on Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan, Leviathan Mine Site, Alpine County, California, Leviathan Mine Site, Alpine County, California, Dated March 31, 2016.* July 8.
2. Sciacca, J.E., 1984. *Historical and Environmental Geologic Study of the Leviathan Creek Basin Landslide.* Unpublished Master of Science Thesis, University of California, Davis.

APPENDIX C

Approach for Resolving Geotechnical Engineering Data Gaps

APPENDIX C

APPROACH FOR RESOLVING GEOTECHNICAL ENGINEERING DATA GAPS

Leviathan Mine Site
Alpine County, California

1.0 INTRODUCTION

This appendix summarizes the approach for resolving geotechnical engineering data gaps for the Leviathan Mine Site (site) in Alpine County, California. Geotechnical engineering information is necessary during the various stages of the CERCLA process, for example to inform the screening and evaluation of potential remedial alternatives during the Feasibility Study (FS) and to provide the necessary data during the Remedial Design (RD) phase after a remedy has been selected. To aid in the understanding of the geotechnical engineering data gaps present at the site, a Geotechnical White Paper (WP) was prepared in 2015. The Geotechnical WP provided a review of existing site related geotechnical information available at the time, and identified potential site related geotechnical data gaps. However, the Geotechnical WP did not identify when in the CERCLA process geotechnical engineering data gaps might need to be resolved (i.e. – during the FS versus the RD phase).

This appendix has been developed to bridge the Geotechnical WP to subsequent activities and to facilitate understanding when geotechnical data gaps identified in the Geotechnical WP may come into play during various phases of the CERCLA process (FS versus RD). It also summarizes the approach for resolving geotechnical engineering data gaps.

Amec Foster Wheeler Environment and Infrastructure, Inc. is conducting the FS on behalf of the Atlantic Richfield Company (Atlantic Richfield) in partial fulfillment of the requirements of the Statement of Work attached to the *Administrative Order for Remedial Investigation and Feasibility Study* (also referred to as the Unilateral Administrative Order) issued by the U.S. Environmental Protection Agency Region IX to Atlantic Richfield on June 23, 2008 (U.S. EPA, 2008).

2.0 APPROACH

Geotechnical information will be needed to establish baseline conditions and to better inform the FS that will evaluate remedial alternatives for the site. Geotechnical information may also be needed to design and implement the selected remedy. The general process of compiling and evaluating existing and new geotechnical information is a step-wise process, with each

step generally requiring more focused information. The steps that are being or will be performed to support the FS and post-FS remedial design are as follows.

☐ Initial Compilation and Review of Existing Information and Data Gap Identification

Compilation and review of existing geotechnical information and initial scoping of potential geotechnical data gaps was described in *Geotechnical White Paper / Engineering Evaluation, Feasibility Study White Paper / Engineering Evaluation WP/EE 14* (the Geotechnical WP) prepared by Atlantic Richfield. The Geotechnical WP was Appendix A of the draft *Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan, Leviathan Mine Site, Alpine County, California* (the Geotechnical TSAP) (Atlantic Richfield, 2016). The Geotechnical WP was used as the basis for understanding the data gaps that need to be filled in order to better inform the FS and was used to support planning for the FS. The Geotechnical WP identified a broad range of data gaps, including some that pertain to FS evaluation of remedial alternatives and others that may (depending on the selected remedy) pertain to geotechnical engineering during remedial design as part of implementing a selected remedy.

☐ Geotechnical Focused Feasibility Study

The Geotechnical WP provided a basis for identifying data collection and evaluation needed to inform the FS. The Geotechnical TSAP was prepared to guide focused geotechnical characterization at the site to better inform the FS. The Geotechnical TSAP activities included review of existing core samples, geologic/geotechnical mapping, geophysical surveys, geotechnical drilling, sample collection and laboratory analysis, and monitoring of potential slope movement and pore pressure.

☐ Geotechnical Baseline Evaluation

Some of the identified geotechnical data gaps that are needed to inform the FS can be resolved based on existing or readily available information, and do not require collection of additional site specific characterization data. Hence, these data gaps are not addressed by the Geotechnical TSAP. Data gaps needed to support the FS that can be resolved using existing or readily available information pertain to seismic hazards at the site, design criteria, and the Leviathan Creek Basin Landslide. For example, seismic hazards for the site can be determined using publically available databases to identify the potential ground accelerations during seismic events, and existing site specific information about soil types. The information of this type that is needed to inform the FS will be compiled and evaluated in a geotechnical baseline evaluation report in time to support the FS.

☐ Feasibility Study

The FS will develop various remedial alternatives for the site, and will evaluate those alternatives using criteria specified in the National Contingency Plan (NCP). Geotechnical considerations may affect the effectiveness, implementability, and cost of remedial alternative components. The information compiled via the

Geotechnical TSAP and the baseline evaluation will inform the FS to conduct the remedial alternative evaluations. In addition, geotechnical engineering calculations that apply to particular remedy components may be needed to support remedial alternative evaluations. Those calculations will be performed as needed as part of the FS, but collection of additional characterization data is not planned. These remedy specific engineering calculations can be performed only after the remedial alternatives have been identified, and hence must be performed during the FS. Those analyses will be documented in the FS report.

☐ Remedial Design

Following the FS, a Record of Decision (ROD) will identify the remedy for the site. In the event that geotechnical engineering design is needed to implement the selected remedy, then additional geotechnical characterization information needed to support that design, if any, would be collected as part of remedial design. Identifying the data needs, planning and implementing data collection, data interpretation, and engineering design are all remedial design activities, and would be reported in remedial design documents.

3.0 STATUS

The status (as of February 2017) of the activities described in Section 2 is as follows.

☐ Initial Compilation and Review of Existing Information and Data Gap Identification

This activity has been completed, and was reported in *Geotechnical White Paper / Engineering Evaluation, Feasibility Study White Paper / Engineering Evaluation WP/EE 14*. The Geotechnical WP is a historic document that was prepared as part of the FS planning process. That document has served its purpose, and does not warrant revision or updating.

☐ Geotechnical Focused Feasibility Study

Most of the characterization activities described in *Focused Feasibility Study Geotechnical Evaluation Task Sampling and Analysis Plan, Leviathan Mine Site, Alpine County, California* (Atlantic Richfield, 2016) were completed in 2016, and the remaining activities are scheduled for completion in 2017 in time to inform the FS. Activities conducted in 2016 include: review of existing core; geologic/geotechnical mapping; geophysical surveys; one geotechnical boring was completed; a second geotechnical boring was drilled through mine waste but drilling was not completed due to the onset of winter conditions. This borehole (GB-01) will be deepened and instrumented in 2017. Geotechnical laboratory analysis of samples collected in 2016 will be completed in 2017. Activities that are scheduled to be performed in 2017 are: drilling one borehole that was partially drilled in 2016 to its target depth; conducting a televiwer survey in that borehole; installing instrumentation and monitoring potential slope movement and pore pressure; and completing geotechnical laboratory analysis. Results will be documented in a FFS report in 2017 in time to inform the FS.

☐ Geotechnical Baseline Evaluation

The compilation and evaluation of existing and readily available information is in progress and will be documented in a baseline evaluation study report in 2017 that will be completed in time to inform the FS.

☐ Feasibility Study

The remedial alternatives to be evaluated will be developed in the first portions of the FS. After the remedial alternatives have been identified, geotechnical engineering calculations will be performed as needed to support the FS evaluation of remedial alternatives. The geotechnical engineering calculations will be documented in the FS report in 2018.

☐ Remedial Design

Geotechnical engineering activities associated with remedial design will be conducted after the FS has been completed and the ROD identifies the remedy for the site.

4.0 REFERENCES

Atlantic Richfield, 2016. Focused Feasibility Study, Geotechnical Evaluation Task Sampling and Analysis Plan, Leviathan Mine Site, Alpine County, California. Draft, March 31.

Brown and Caldwell, 1983, Leviathan Mine Pollution Abatement Project Design Report and Draft Environmental Report. April.

Kleinfelder, 2001a. Geotechnical Investigation Report, Phase I Preliminary Slope Stability Evaluation Leviathan Mine Delta Area Waste Pile, Alpine County, California. Kleinfelder, Inc., March 16.

Kleinfelder, 2001b. Geotechnical Investigation Report, Phase II Preliminary Slope Stability Evaluation Leviathan Mine Delta Area Waste Pile, Alpine County, California. Kleinfelder, Inc., April 30.

Kleinfelder, 2003. Geotechnical Slope Stability Evaluation Leviathan Mine Delta Area Waste Pile, Alpine County, California. Kleinfelder, Inc., July 30.

Kleinfelder, 2006. Summary of Material Testing and Observation Services, Geotechnical Slope Stability, Leviathan Mine Delta Area Waste Pile, Alpine County, California. Kleinfelder, Inc., February 9.

U.S. EPA, 2008. Administrative Order for Remedial Investigation and Feasibility Study, Leviathan Mine, Alpine County, California, U.S. EPA Region IX, CERCLA Docket No. 2008-18.